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Eating behaviours and obesity in the adult population of Spain

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To examine the association between several eating behaviours and obesity, data were taken from a cross-sectional study conducted with 34 974 individuals aged 25–64 years, representative of the non-institutionalised Spanish population. Obesity was defined as BMI $\geq$ 30 kg/m^2. Study associations were summarised with OR obtained from logistic regression, with adjustment for socio-demographic and lifestyle factors. The results showed that those skipping breakfast were more likely to be obese, both in men (OR 1·58; 95 % CI 1·29, 1·93) and women (OR 1·53; 95 % CI 1·15, 2·03). Moreover, obesity was more prevalent in those having only two meals per day than in those having three or four meals in men (OR 1·63; 95 % CI 1·37, 1·95) and women (OR 1·30; 95 % CI 1·05, 1·62). Also, snacking was associated with obesity in women (OR 1·51; 95 % CI 1·17, 1·95). However, no association was observed between obesity and having one or more of the main meals away from home, in either sex. In conclusion, skipping breakfast and eating frequency were associated with obesity. The lack of association between eating away from home and obesity is in contrast to most previous research conducted in Anglo-Saxon countries. Differences in the type of establishment frequented when eating out or in the characteristics of restaurant customers in a Mediterranean population might explain these conflicting results.

Obesity: Eating behaviour: Eating away from home: Snacking

Obesity is a multifactorial disorder deriving from genetic and metabolic factors as well as environmental factors, socio-economic and behavioural[1,2]. These factors differ in their respective contributions to the obesity epidemic in recent decades[3]. Since genetic factors and their influence on the energy balance have not changed substantially[4], they are unlikely to be responsible for the increase in obesity. Behavioural factors, however, have undergone important modifications that might account for the epidemic in obesity[5].

Among the behavioural factors, sedentariness and eating play a major role[6]. Nonetheless, analysis of the influence of energy intake and of the percentage of energy intake from specific nutrients has not yielded consistent results. Obesity has risen in countries where energy intake has increased sharply in recent years, as well as in others where it has decreased; similarly, it has risen in countries where fat intake has increased and in others in which it has decreased[7,8]. Consequently, research has focused on new factors related to eating behaviour. Pre-eminent among these are: food consumption frequency; temporal distribution of the meals throughout the day; skipping one of the main meals, particularly breakfast; and frequency of meals eaten away from home (‘eating out’). However, research on the influence of these factors on obesity is not conclusive: whereas some studies have reported no association between frequency of meals and obesity[9,10], others reported a high frequency of food-consumption episodes as having a protective effect on obesity[11–15]. Furthermore, individuals who skip breakfast register a higher frequency of obesity[13], though this could due to the fact that having no breakfast is associated with worse diet quality[16]. Indeed, having no breakfast is an ineffective way of losing weight[17].

One of the factors with greatest interest is eating out. Some studies have shown a relationship between body weight and the frequency of food consumption at restaurants, particularly fast-food establishments[18,19]. Among the reasons given for such association were the higher energy intake due to the larger size of portions, or the high energy density of certain foods served in many restaurants[20,21].

Almost all previous studies on these issues have been conducted in Anglo-Saxon countries, particularly the USA. The model of socio-economic development that underlies some of the changes in eating behaviour, such as the increase in food consumption away from home, is common to the entire Western world. However, the influence of these factors on obesity could vary between populations, given the enormous differences in dietary patterns between countries, for instance between the Mediterranean and those of Northern Europe or America.

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This study examines the association between several eating behaviours and obesity in a representative sample of the adult population of Spain; in addition, it analyzes the influence of socio-demographic and lifestyle factors on such association.

Participants and methods

Data were drawn from the 1999 Survey on Disabilities, Impairments and Health Status (*Encuesta Sobre Discapacidades, Deficiencias y Estado de Salud*) which covered a representative sample of the non-institutionalised Spanish population. Study participants were selected through two-stage stratified sampling. First, census sections were randomly selected, stratified by town size and socio-economic level of the households. Second, random-start systematic sampling was used to select family dwellings, where one person was chosen at random to answer the questionnaire. A total of 69 555 interviews were conducted at the participant's households by trained personnel. We restricted our analyses to the 35 190 individuals aged 25–64 years. After excluding 216 subjects with missing data on some variable of interest, the final number of participants included in the analyses was 34 974.

The dependent variable was obesity. This was estimated from the BMI, calculated as weight in kilograms divided by the square of the height in metres (kg/m^2). Self-reported weight and height were obtained with the following question: 'What is your weight and height without shoes and clothes on?' Obesity was defined as BMI $\geq$ 30 kg/m^2.

The main independent variables were some eating habits in the 6 months preceding the interview. For each of the three main meals (breakfast, luncheon, dinner), information was obtained on whether the meal was eaten regularly, and whether it was eaten at home or away from home. Accordingly, each of the three meals was classified as: eaten regularly at home; eaten out; not eaten. Also, data were collected on eating frequency, which refers to the number of meals per day, categorised as follows: three or four meals (including the three main meals and afternoon tea); two meals (two of the main meals); one meal (one main meal); and several times per day (eating small amounts of food many times over the course of the day).

Information was also obtained for a number of potential confounders. Among these, there were socio-demographic variables, such as sex, age, size of town of usual residence ($<$10 000, 10 001–50 000, 50 001–500 000 and $>$500 000 inhabitants), and education, classified into low level (no formal education and primary education) and high level (secondary and university education). Also, there were lifestyle variables, such as smoking, with the following categories: non-smokers (neither smoke nor have ever done so previously), ex-smokers (do not smoke but did so previously) and smokers (smoke daily or occasionally); alcohol consumption, with participants classified as: abstainers (do not consume alcohol), occasional drinkers (consume alcohol once per week or less), frequent drinkers (consume alcohol two to six times per week) and daily drinkers (consume alcohol daily); and leisure-time physical activity, in two categories: sedentary (no physical exercise during leisure time) and active (some physical activity occasionally or several times per week or month). Finally, self-perceived health was classified as good (very good or good) or poor (fair, poor or very poor).

The association between the principal independent variables and obesity was summarised with OR and their 95 % CI obtained from logistic regression. Four types of models were built: a crude model; an age-adjusted model; a model adjusted for age, health status and lifestyle variables; and a saturated model, which, in addition to the above variables, also adjusted for socio-demographic factors. Separate analyses were conducted for men and women.

Statistical significance was set at two-tailed $P<0.05$. Analyses were performed with the SPSS version 12.0 software (SPSS Inc., Chicago, IL, USA).

Results

Table 1 shows the prevalence of obesity according to socio-demographic and lifestyle characteristics. Obesity increased with age, rising to 17 % in men and 20 % in women in the 55–64 age group. Obesity was more prevalent among sedentary individuals, ex-smokers, subjects reporting poor health status, and those with a low educational level.

Table 2 shows the distribution of obesity by the eating behaviours studied. Obesity was more prevalent among subjects who usually skipped breakfast, ate their midday meal at home, and reported not having dinner. Furthermore, among men, obesity was more prevalent in those who had two meals per day. Among women, in contrast, prevalence of obesity was higher in those who ate several times per day.

Tables 3 and 4 show the OR of obesity according to eating behaviour. Among men, absence of breakfast was associated with obesity, so that in the saturated model those skipping breakfast had an OR of obesity of 1·58 (95 % CI 1·29, 1·93) as compared with those having breakfast at home (Table 3). Similar results were obtained for women, with an OR 1·53 (95 % CI 1·15, 2·03) in the saturated model (Table 4). Eating breakfast out versus at home showed no association with obesity in either sex.

No relationship was observed between the main midday meal and obesity. Only in women who regularly went out for lunch was an inverse association found, with an OR of 0·52 (95 % CI 0·43, 0·73) in the crude analysis, and an OR of 0·78 (95 % CI 0·64, 0,95) in the age-adjusted model (Table 4). However, this association did not remain significant after adjustment for lifestyle (OR 0·88; 95 % CI 0·72, 1·07) and socio-demographic characteristics (OR 1·03; 95 % CI 0·84, 1·26).

As for dinner, no association with obesity was found in men. In contrast, women who had no dinner showed a higher prevalence of obesity than those who had dinner at home (age-adjusted OR 1·76; 95 % CI 1·29, 2·41). This association also reached statistical significance in the saturated model (OR 1·66; 95 % CI 1·20, 2·29) (Table 4). Dining out versus at home showed no relationship with obesity across the sexes.

Lastly, we found an association between food frequency and obesity. Compared to having three or four meals per day, having only two showed an age-adjusted OR of obesity of 1·67 (95 % CI 1·41, 1·99) in men and 1·35 (95 % CI 1·09, 1·67) in women. This association also held after additional adjustment for lifestyle and socio-demographic characteristics in men (OR 1·63; 95 % CI 1·37, 1·95) and women (OR 1·30; 95 % CI 1·05, 1·62). Eating several smaller-sized meals per day likewise displayed an association with obesity, with an

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Table 1. Number of individuals, number of obese subjects and prevalence of obesity according to demographic and lifestyle characteristics in Spanish men and women aged 25–64 years*

	Men			Women		
	n	No. obese	Prevalence (%)	*n*	No. obese	Prevalence (%)
Age (years)						
25–34	4792	368	7·7	4762	189	4·0
35–44	4389	470	10·7	4403	339	7·7
45–54	3874	546	14·1	4206	624	14·8
55–64	3874	661	17·1	4674	967	20·7
Trend *P* value			*P*< 0·001			*P*< 0·001
Physical activity						
Sedentary	7435	1107	14·9	8215	1169	14·2
Active	9494	938	9·9	9830	950	9·7
Smoking						
Non-smoker	5606	620	11·1	11 030	1641	14·9
Smoker	7735	833	10·8	5207	303	5·8
Ex-smoker	3588	592	16·5	1808	175	9·7
Alcohol consumption						
Abstainer	5513	684	12·4	11 631	1622	13·9
Occasional	3279	374	11·4	3383	254	7·5
Frequent	2851	328	11·5	1403	90	6·4
Daily	5286	659	12·5	1628	153	9·4
Health status						
Good	13 421	1417	10·6	12 904	1021	7·9
Poor	3508	628	17·9	5141	1098	21·4
Educational level						
High	9275	842	9·1	9095	464	5·1
Low	7654	1203	15·7	8950	1655	18·5
Town size (inhabitants)						
< 10 000	3926	551	14·0	3825	559	14·6
10 001–50 000	4045	504	12·5	4178	519	12·4
50 001–500 000	6947	772	11·1	7746	817	10·5
> 500 000	2011	218	10·8	2296	224	9·8
Trend *P* value			*P*< 0·001			*P*< 0·001
Marital status						
Single	5847	567	9·7	5938	540	9·1
Married	11 082	1478	13·3	12 107	1579	13·0

* For details of procedures, see Participants and methods.

Table 2. Number of individuals, number of obese subjects and prevalence of obesity according to eating habits in Spanish men and women aged 25–64 years*

	Men			Women		
	n	No. obese	Prevalence (%)	*n*	No. obese	Prevalence (%)
Breakfast						
At home	13 367	1574	11·8	16 472	1960	11·9
Away from home	2805	342	12·2	1152	91	7·9
No breakfast	757	129	17·0	421	68	16·2
Luncheon						
At home	12 852	1588	12·4	16 164	1989	12·3
Away from home	4029	456	11·3	1811	124	6·8
No lunch	48	1	2·1	70	6	8·6
Dinner						
At home	15 529	1873	12·1	17 190	2030	11·8
Away from home	1231	146	11·9	567	37	6·5
No dinner	169	26	15·4	288	52	18·1
Daily eating frequency						
Three or four times	15 180	1752	11·5	16 360	1877	11·5
Twice	1001	174	17·4	815	110	13·5
Once	191	28	14·7	175	25	14·3
Several times (small amounts of food)	244	40	16·4	476	84	17·6

* For details of procedures, see Participants and methods.

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Table 3. OR and 95 % CI of obesity according to eating habits in Spanish men aged 25–64 years

	Crude		Adjusted for age		Adjusted for age and lifestyle*		Adjusted for age, lifestyle and socio-demographic factors†	
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Breakfast								
At home	1·00		1·00		1·00		1·00	
Away from home	1·04	0·92, 1·18	1·13	0·99, 1·28	1·12	0·98, 1·27	1·12	0·99, 1·28
No breakfast	1·54	1·26, 1·87	1·61	1·32, 1·97	1·55	1·30, 1·89	1·58	1·29, 1·93
Luncheon								
At home	1·00		1·00		1·00		1·00	
Away from home	0·91	0·81, 1·01	1·00	0·89, 1·12	1·01	0·90, 1·13	1·03	0·92, 1·15
No lunch	0·16	0·02, 1·10	0·19	0·03, 1·29	0·18	0·03, 1·27	0·19	0·03, 1·31
Dinner								
At home	1·00		1·00		1·00		1·00	
Away from home	0·98	0·82, 1·17	1·11	0·93, 1·33	1·11	0·93, 1·33	1·14	0·95, 1·37
No dinner	1·33	0·87, 2·02	1·35	0·88, 2·06	1·25	0·81, 1·91	1·29	0·84, 1·98
Daily eating frequency								
Three or four times	1·00		1·00		1·00		1·00	
Twice	1·61	1·36, 1·91	1·67	1·41, 1·99	1·62	1·36, 1·93	1·63	1·37, 1·95
Once	1·31	0·88, 1·97	1·38	0·92, 2·10	1·34	0·89, 2·02	1·42	0·94, 2·14
Several times (small amounts of food)	1·50	1·07, 2·11	1·50	1·06, 2·12	1·43	1·01, 2·03	1·42	0·99, 2·01

* Physical activity, smoking, alcohol consumption and health status.
† Educational level, size of town of residence and marital status.

age-adjusted OR of 1·50 (95 % CI 1·06, 2·12) in men and 1·63 (95 % CI 1·28, 2·09) in women. Among women, this association remained significant in the saturated model (OR 1·51; 95 % CI 1·17, 1·95). Among men, the association still held on adjusting for lifestyle (OR 1·43; 95 % CI 1·01, 2·03) but not after additional adjustment for socio-demographic characteristics (OR 1·42; 95 % CI 0·99, 2·01).

Discussion

In the present study, skipping breakfast and eating two times or less per day were associated with obesity in both sexes, while snacking was associated with obesity in women. However, no association was observed between obesity and having any of the main meals away from home.

As for breakfast, the present results coincide with those in other populations, where skipping breakfast has been associated with a higher BMI and obesity[13,17]. Of note is that we have observed this association in a country, such as Spain, in which breakfast is much lighter than in the USA, where most previous research was done. With respect to the mechanisms of this association, some studies in the USA and Finland have shown that having breakfast is usually accompanied by a better dietary macronutrient composition and certain healthy

Table 4. OR and 95 % CI of obesity according to eating habits in Spanish women aged 25–64 years

	Crude		Adjusted for age		Adjusted for age and lifestyle*		Adjusted for age, lifestyle and socio-demographic factors†	
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Breakfast								
At home	1·00		1·00		1·00		1·00	
Away from home	0·64	0·51, 0·79	0·85	0·68, 1·06	0·95	0·75, 1·19	1·07	0·86, 1·36
No breakfast	1·43	1·09, 1·86	1·65	1·26, 2·17	1·56	1·18, 2·06	1·53	1·15, 2·03
Luncheon								
At home	1·00		1·00		1·00		1·00	
Away from home	0·52	0·43, 0·73	0·78	0·64, 0·95	0·88	0·72, 1·07	1·03	0·84, 1·26
No lunch	0·67	0·29, 1·54	0·88	0·38, 2·08	1·03	0·44, 2·42	1·15	0·48, 2·72
Dinner								
At home	1·00		1·00		1·00		1·00	
Away from home	0·52	0·37, 0·73	0·77	0·55, 1·08	0·91	0·64, 1·28	1·03	0·84, 1·26
No dinner	1·65	1·21, 2·23	1·76	1·29, 2·41	1·60	1·16, 2·21	1·66	1·20, 2·29
Daily eating frequency								
Three or four times	1·00		1·00		1·00		1·00	
Twice	1·20	0·98, 1·48	1·35	1·09, 1·67	1·30	1·05, 1·62	1·30	1·05, 1·62
Once	1·28	0·84, 1·97	1·28	0·83, 1·99	1·11	0·71, 1·74	1·11	0·71, 1·79
Several times (small amounts of food)	1·65	1·30, 2·10	1·63	1·28, 2·09	1·53	1·19, 1·97	1·51	1·17, 1·95

* Physical activity, smoking, alcohol consumption and health status.
† Educational level, size of town of residence and marital status.

habits, such as regular physical exercise or alcohol abstention, which would reduce the risk of obesity[16,22]. Individuals who skip breakfast also have an inadequate energy intake and a certain tendency to compensate for the energy needs not supplied at breakfast time with nutrient-poor, fat-rich foods[23]. Furthermore, in obesity treatment programmes, eating breakfast reduces dietary fat content and frequency of snacking, which in turn leads to weight loss[24]. The effect of breakfast protecting from obesity, coupled with the decreasing trend in breakfasting in some countries with a high prevalence of obesity[25], suggests that a recommendation to have breakfast should be included in programmes addressing obesity in developed countries.

In the present study, women who did not have dinner were more likely to be obese. Other studies have reported a positive relationship between eating at night and obesity, especially when dinner is eaten late[13]. An explanation for this association has been sought in the accumulation of energy in the form of glycogen after eating a carbohydrate-rich dinner late at night, which would prevent such energy from being rapidly used and, thus, favour its accumulation[26]. It is likely that the present results are due to the cross-sectional study design. Specifically, obese women might reduce their daily intake, especially during dinner, with the intention of controlling their weight. In men, we did not find an association between obesity and not having dinner, possibly because men are less concerned than women about body image and overweight. This is highlighted by the lower percentage of men who undergo diets and other slimming treatments[27].

In comparison with having three or four meals per day, having only two meals was associated with obesity in both sexes. Frequent intake over the course of the day has shown a certain protective effect against obesity in some studies[11,12,14]. It has been suggested that frequent meals would lead to a relatively higher intake of carbohydrates and, by extension, a lower fat intake (a higher carbohydrate:fat ratio), which would reduce weight. The present results could also be due to the cross-sectional design, because individuals with a higher BMI could restrict the number of meals to control weight. Nevertheless, restriction of intake could paradoxically increase BMI, because it might coexist with episodes of unrestrained eating[28]. In any case, the association between meal frequency and obesity is not consistent across the literature, since there are also studies that fail to find this association[9] or even report conflicting results between cross-sectional and longitudinal analyses of their data[10].

We observed a clear association between obesity and eating several meals involving smaller quantities of food than those consumed at the main meals. This pattern, which could be likened to snacking, has frequently been associated with obesity. Snacking would lead to a higher intake of saturated fats and of total energy, which would not be offset by a reduction in main meals[15,29]. The association between obesity and snacking could also be due to the irregularity of this eating pattern, because there is recent experimental evidence that following an irregular diet had prejudicial effects on thermogenesis, fasting lipids and postprandial insulin profile[30]. There are also studies, however, that report no association whatsoever between snacking and obesity[31,32]. Hampl *et al.* [31] failed to observe that snacking was accompanied by higher BMI[29], despite the greater energy intake among those indulging in snacking. Yet their study did not take physical activity into account, which might explain the unexpected results.

One of the most interesting results is the absence of association between obesity and regularly eating away from home, since it contradicts previous research. In such studies, the higher prevalence of obesity in those eating out may be due to a number of mechanisms. In the USA and UK, regularly eating away from home is associated with a higher energy and fat intake and a lower fibre intake[18,33]. This results from the consumption of energy-dense foods, served in larger portions than those at home[21]. The higher energy intake also results from a greater social stimulus for food intake at restaurants, because individuals tend to eat more when in the presence of others[34].

Most of the evidence on this association is based on eating at fast-food restaurants. The food of these establishments has been associated with high energy density[35], larger-sized portions, and obesity and its consequences[20,36]. Indeed, two studies have investigated the effect of food consumption in fast-food restaurants in a Mediterranean cohort, and they did observe an association between BMI and obesity[37,38]. Yet, despite the sharp rise in the number of these restaurants in Spain in recent years[39], fast-food restaurants might still be poorly frequented compared to the more traditional establishments, where the cuisine comes closer to the model of the Mediterranean diet, which has shown a protective effect against obesity[40]. This may explain the absence of association between eating out and obesity in Spain.

The present study has some limitations. First, because it was a cross-sectional study, causal inference is limited. For instance, skipping breakfast could be both a cause and consequence of obesity, since obese subjects might eliminate breakfast to lose weight.

Second, the questions on eating location have not been validated. However, the questions used are simple enough to expect not many problems with classification, because people should easily remember the place where they usually eat. Also, we are not aware of reasons why such potential classification errors might vary between the obese and the non-obese, or according to socio-demographic and behavioural characteristics. Thus, had such errors occurred, their influence on the present results is probably small.

Third, because data on eating behaviours were self-reported we cannot exclude some classification bias. There is no reason, however, to believe that such bias might have been different between the obese and the non-obese subjects. Indeed, obese subjects might well tend to conceal more frequent food consumption, so that the observed effect of snacking on obesity could be underestimated.

Fourth, we have not measured individuals' intake. However, controlling the study association for food and nutrient intake could be interpreted as over-adjustment, because food and nutrient intake is one of the mediators of the association between obesity and eating away from home. Had food and nutrient data been available, we would have been able to explore some mechanisms of the study association. Yet, we believe that the inability to examine such mechanisms does not reduce the importance of finding that eating out is not associated with obesity in Spain, in contrast to several Anglo-Saxon countries.

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Fifth, we did not obtain data on household composition, despite it surely influencing eating behaviours. Nevertheless, we made an attempt to account for it, because our analyses adjusted for many socio-demographic (age, education, marital status) and lifestyle variables which are correlated with household composition. Accordingly, we expect that the effect of household composition on the present results should be relatively small.

Lastly, we acknowledge that parity is a predictor of overweight in women. In Spain, parity is also strongly associated with marriage, education and age. Our logistic models are already adjusted for these variables. Because further adjustment for parity did not materially change the results, we decided to exclude parity from the multivariate analysis. Moreover, the fact that ‘eating out’ and obesity were neither associated in men, supports that parity and other sex-linked variables are not crucial for the study association.

Notwithstanding these limitations, the present study is important because it is the first to investigate the relationship between eating out and obesity in a Mediterranean country. The absence of association between obesity and eating out would suggest the enormous variability in the impact of certain eating habits on obesity across countries.

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